IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS)
ISSN(E): 2321-8851; ISSN(P): 2347-4580
Vol. 2, Issue 12, Dec 2014, 43-48

GEOMORPHOLOGICAL STUDY OF THE UPPER KUNDALIKA RIVER BASIN, RAIGAD, MAHARASHTRA

SACHIN. K. PISE[1] & SURENDRA. C. THAKURDESAI[2]

[1]Annasaheb Vartak College of Arts, K. M. College of Commerce and E. S. A College of Science, Vasai, Palghar, Maharashtra, India

[2]Gogate Joglekar College, Ratnagiri, Maharashtra, India

ABSTRACT

The Upper Kundalika river basin covers an area 387.51 sq.km. It rises on the western Ghats.The basin exhibits a dendritic pattern with a number of segments controlled by lineaments present in the basin. The Upper Kundalika river basin is an elongated, fifth order basin. The bifurcation ratio is 2 indicating a young stage of development. The length ratio is found to be 1.28.

KEYWORDS: Linear Aspects, Areal Aspects and Relief Aspects

INTRODUCTION

Morphometry is the precise & an objective measurement of landform morphology and it involves quantitative analysis of geometric properties of the future. Strahler A.N.(1957) describes the term morphometry as a measurement of the shape or geometry of any natural form. Clarke, J. I. (1970) defines morphometry as the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimensions of the land forces.

Morphometry is divided into two branches Singh Savindra(2000) 1) Relief Morphometry 2) Fluvial Morphometry. Relief Morphometry includes an analysis of the relief of the terrain with the help of absolute relief relative relief, slope, aspect etc. While fluvial morphometry includes the consideration of linearity, areal and relief aspect of fluvial originated drainage basin. In a linear aspect analysis related to streams such as stream order hierarchy, stream numbers, stream length etc. is done. Areal analysis includes the study of the basin parameter shape of the basin.

ABOUT STUDY AREA

The latitudinal extent of the study sector is 18°35"to 18 °57" North and longitudinal extent is 72 °40" to 73 11" East. The Kundalika maintains fairly straight course in E - W direction up to Roha and then follows as SE-NW trend. The Kundalika is a small river flowing from the Hills of Sahyadri to the Arabian Sea. This river originates at a small town called Bhira in the Indian State of Maharashtra, 150 km south east of Bombay (Mumbai). The important towns located on the banks of Kundalika are Kolad, Korlai, Chaul, Roha and Salav**.** The river channel in this area is very shallow and even in case of main rivers the relief along the blanks is about 3-4 m. The tributary stream also has a very shallow channel. The soil cover in most of these areas is poor and rocky exposures are quite commonly observed.

Drainage Pattern

The Upper Kundalika river basin elongated along NE-SW direction. The basin exhibits a dendritic pattern of drainage in general which is typical of homogeneous crystalline rocks.

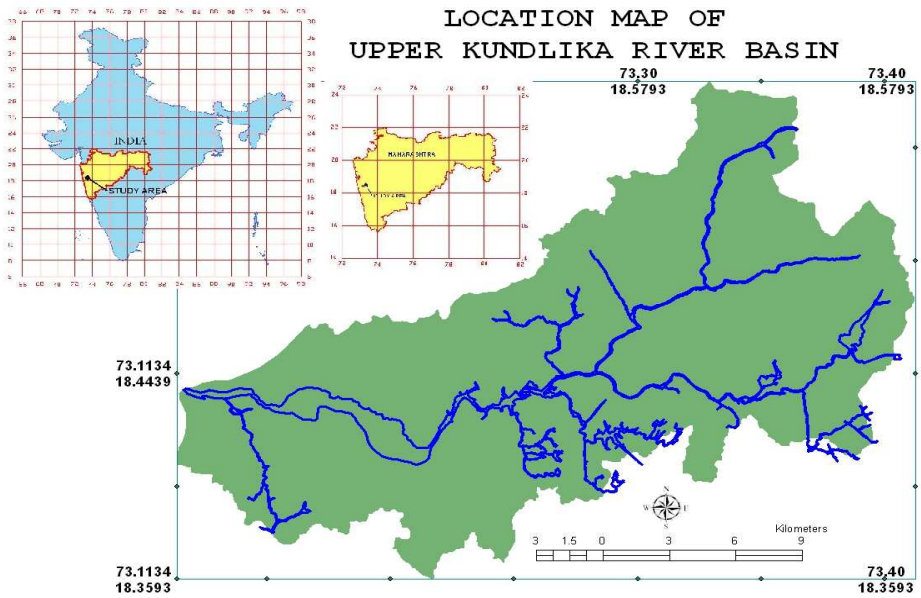

Figure 1

METHODOLOGY

Toposheet on the scale 1:50,000 are used for the morphometric analysis of the upper kundalika basin. For convenience, the fluvial morphometric analysis of the basin is divided into three aspects linear, areal and relief aspects. GIS 10 software used for calculating stream order, number and area.

LINEAR ASPECTS OF THE BASIN

- **Stream Order:** Three are different methods of designating the stream order, however, the modified method of Strahler (1952) is adopted for the present analysis, the number of segments of each order is tabulated in table 1. The Upper Kundalika Basin is a fifth order with segments in first, second, third, fourth and fifth order respectively.

It is further observed that there are more number of channels of a particular order than the next higher order. This observation leads to the recognition of bifurcation ratio (Rb). Which is the ratio between the number of a given order (Nu) to the number of segments of the next higher order (Nu+1). Mathematically, it is designed as

Rb = Nu/Nu+1

The bifurcation ratio for each set of streams has been calculated in table 1. The bifurcation ratio of the Upper Kundalika Basin is 2. Which indicates the young stage (Horton,1950).

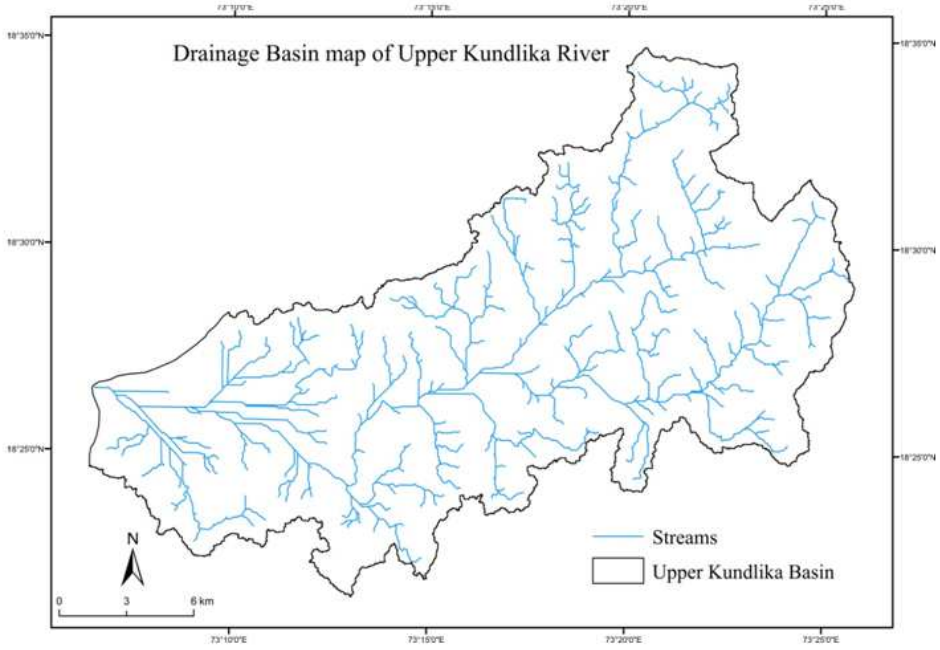

Figure 2

- **The Stream Length:** Has an important relationship with the surface flow discharge, longer the length slows the appearance of flood and larger the surface flow.Horton observed that the mean length of channel segments of a given order in a particular ratio called "length ratio", Which is defined as the ratio of the mean channel length of an order (Lu) to that the lower order (Lu+1), Mathematically the length ratio (RL) is given by the following formula:

  RL = Lu/Lu+1

  The length ratio of the Upper Kundalika basins value presented in table 1.

The study of stream lengths which states that the cumulative mean lengths of stream segments of successive orders of a basin tend to form a direct geometric sequence in which the first term is the average length of first order segments.

Table 1: Giving Different Morphometric Characters of the Upper Kundalika River Basin

Stream Order (U)	Total No of Segments (Nu)	Bifurcation Ratio (Rb)	Mean Length of Segment IN Kms (Lu)	Length Ratio (RL)
1	345	2.42	197.2	1.94
2	142	1.65	101.59	2.00
3	86	43	50.55	1.69
4	2	2	29.86	1.28
5	1	-----	23.27	------

AREAL ASPECTS OF THE BASIN

- **Law of Stream Areas:** Are governed by the mean basin areas of successive stream orders, that tend to form a direct geometric series beginning with the mean basin area of the first order basins and increases with the constant area ratio (Schumm, 1956). The law can be stated mathematically asunder:-

$$Au = A1.Ra^{n-i}$$

Where, A is mean area of the basin of u order, A1 is the mean basin area of the first order basin and R is an area ratio similar to the length ratio RL. The basin of different orders 1-5 have been calculated and the corresponding area is determined as for the Upper Kundalika river basin. The main area plotted against stream orders, exhibits appositive relation.

Table 2: Areal Aspects of the Upper Kundalika River Basin

1	Basin area	387.51 sq.km
2	Maximum length of the basin	37.33 kms
3	Maximum width of the basin	0.22 kms
4	Perimeter of the basin	75.1 kms
5	Bifurcation ratio	2
6	Length ratio	1.28

BASIN ASPECTS

Basin Shape

The shape or form of the drainage basin, may have effects on the discharge characteristics of a basin. A flood takes a longer time to travel in an elongated basin. A flood takes a longer time to travel in an elongated when compared to a circular basin. Different values obtained using methods suggested to quantify this parameter of a basin are presented in table 2. The parameter like elongation ratio, circularity ratio, etc., are also presented in table 3.

RELIEF ASPECTS

Table 3: Relief Aspects of the Upper Kundalika River Basin

Sr.No.	Shape Factor	Values	Source
1	Form S	5.19	Horton (1932)
2	Shape S	0.19	Corps of Engineer (U.S.A)
3	Shape S	169.68	Horton (1932)
4	Circularity ratio	0.86	Miller (1953)
5	Elongation ratio	0.61	Schumm (1956)
6	Lemniscates ratio	0.89	Chorley (1957)

CONCLUSIONS

Upper Kundalika Basin exhibits a dendritic pattern of drainage with a number of segments controlled by lineaments present in the basin. The basin obeys the law of the stream order and stream length, and the stream areas of the Horton. It is the fifth order basin. The overall slope of the basin is in a SW direction. The bifurcation ratio is 2 and length ratio is 1.28 respectively. Total river basin area is 387.51 and circularity ratio is 0.86. The Upper Kundalika river found dual characteristics, i.e. young and mature stage of erosion.

REFERENCES

1. Gregory & Walling (1973): Drainage basin from & processed Geomorphic approach, Edward Arnold Ltd London.
2. Monkhouse F J & Wilkinson. H. R (1994): Map & diagram.
3. Singh Savindra(2000) :Geomorphology Prayag,Pustak Bhavan,Allahabad.

4. Strahler. A. N: Physical Geography 4th edition, John Valley & Sons, Inc. New York.
5. Vajrappa. H. C. & Srinivas. G. (1989): Geomorphological study of the Kabini river basin, south India. Transactions, Vol. II No.2 pp 43-50.
6. Suresh Lal, (2004): Watershed Development, Management & Technology,Mangal Deep Publication.
7. P. C. Jain, Watershed Management, Keralacalling pp17-19.
8. Chorley, R. J. (1962): Geomorphology and general systems theory U. S. G. S. Prof. Paper 500-B.
9. Horton, R. E(1945): Erosional development of streams and their drainage basin.U. S. G. S. Water Supply Vol. 56, pp 275-370.
10. Leopold, L. B.and Miller, J. P.(1964): Fluvial process in Geomorphology.
11. Strahler, A. N. (1952): Hypsometric Analysis of erosional topography,Vol.73, pp17-37.